

## Terrestrial mammals of Phillip and French Islands, Western Port, Victoria

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### Abstract

Standard survey techniques were used to assess the mammalian fauna of Phillip and French Islands in Western Port, Victoria between 1997 and 2005. In total, 16 native and 7 exotic species were recorded on Phillip Island and 13 native and 8 exotic species on French Island. The most diverse faunal group was the microbats (7 species in total). Species present were compared with those previously recorded on the two islands and the adjacent mainland. Deliberate and accidental introductions since European settlement of both Australian native and non-native species have substantially changed the species present on both islands. The greatest threats to current mammalian fauna on the islands include foxes (currently not resident on French Island), land-clearance, road traffic, and irresponsible human-induced introductions. (*The Victorian Naturalist* 123 (3), 2006, 146-156)

### Introduction

Phillip and French Islands, located in Western Port, central coastal Victoria (Fig. 1) were separated from mainland Australia during sea-level rises approximately 10,000 years ago (Garden 2002). A study of past and present mammalian species on these islands can provide an insight into the local history and influence of humans on island biodiversity. Information on native species prior to European settlement may be inferred from bones in archaeological digs at Aboriginal middens (Gaughwin 1981) and mammal sightings mentioned in accounts of early settlers (Blandowski 1857; Wheelright 1862; Gliddon 1968). As in most Australian environments, European settlement greatly altered the species present. Current terrestrial fauna on the islands are the result of populations that survived the geographic isolation or migrated over water to the islands and by bridge to Phillip Island, and those that have survived human influences, including introductions of exotic and non-endemic, native species.

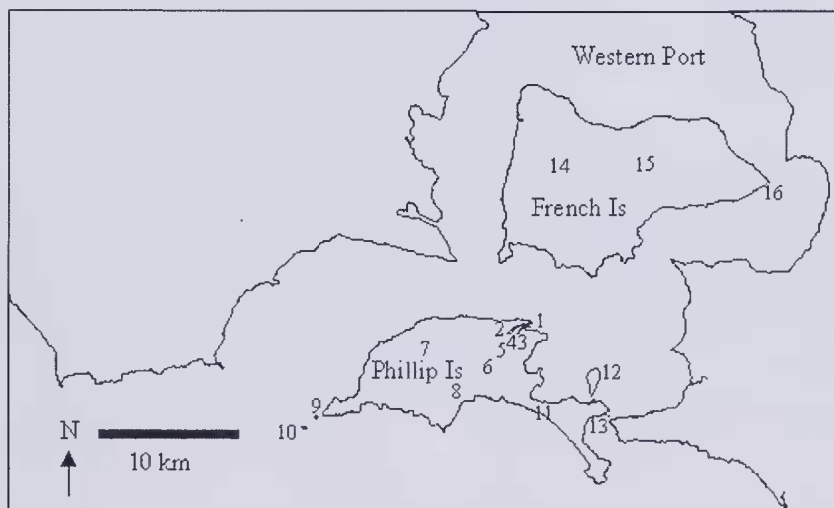
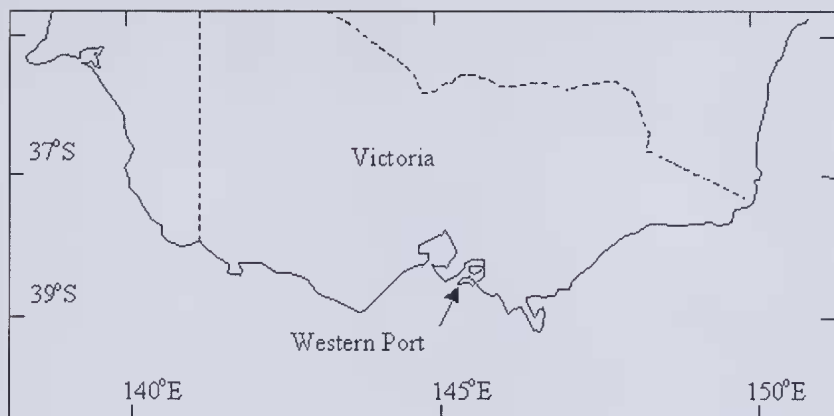
In 1980, a survey of vertebrate species within the Western Port catchment was the first to fully document the mammals present on the islands (Andrew *et al.* 1984). This paper utilises previous records and more recent surveys to document the status and dynamics of mammalian fauna on the islands. The history of human-induced changes on these adjacent islands differs

considerably, and a comparison of their histories provides information on the impacts of anthropogenic manipulations, which are omnipresent in the Australian environment.

### Methods

Phillip Island and Churchhill Island together comprise 100 km<sup>2</sup> of low lying mainly cleared farmland while French Island comprises 200 km<sup>2</sup> of heathland, eucalypt forest and cleared farmland. Between 1997 and 2004, standard survey techniques were used to record the presence and distribution of mammals on these islands. Techniques included Elliott and cage trapping and hair-tubing for small ground mammals (baited with peanut butter and oats or fish), spot-light searches for arboreal and macropod species, strip-transects to record macropod densities in some reserves, harp-trapping for bats, and daytime searches for animal signs. Traps (Elliott, cage and harp) were set at a location for one to three nights and were checked each morning. Surveys were conducted across all seasons. Exotic pest animals were trapped using cage and leghold traps or were shot; their stomach contents were checked for the presence of mammal remains (see methods in Kirkwood *et al.* 2000, 2005).

To broaden the scale of this study, trapping results from several contemporaneous



**Fig. 1.** The location of Western Port, Phillip and French Islands, and sites referred to in the text. 1. Rhyll Inlet; 2. Silverleaves; 3. Rowell Swamp; 4. Conservation Hill; 5. Oswin-Roberts Reserve; 6. Koala Conservation Centre; 7. Ventnor Koala Reserve; 8. Stinker Bay; 9. Point Grant; 10. Seal Rocks; 11. Forest Caves; 12. Churchill Island; 13. San Remo Bridge; 14. Deuschers Swamp; 15. French Island National Park; 16. Spit Point.

research projects were incorporated (Campbell 2000; Harken 2000; Lanyon 2000; Johnston 2002; Scott 2003; Marks *et al.* in press; ). Long-term residents were interviewed for their recollections of species present and records held in the Atlas of Victorian Wildlife Database were reviewed.

## Results

### Phillip Island

Between 1997 and 2004, 135 House Mice *Mus musculus* and 17 Black Rats *Rattus rattus* were caught from a total of 2132 Elliott trap nights in nine areas of

Phillip Island (Table 1). The only indication of the presence of small, native, ground mammals was an area of 'Swamp Rat *Rattus lutreolus* like' runways through dense grass adjacent to Conservation Hill (Fig. 1). In the mid 1980s, a single Swamp Rat was trapped there, photographed and released *in situ* (R Baird 1998 pers. comm.). Trapping and hair-tubing in this area on three occasions in this study failed to record a swamp rat and over the course of the study, the runway systems deteriorated.

During a total of 737 cage trap nights in coastal areas at the western end of Phillip

Table 1. Small mammals caught during Elliott trapping on Phillip Island.

Location	Nights	Trap nights	House mice	Black rats
Summerland Peninsula	4-6 Feb 1998	141	2	.
Ventnor Reserve (a)	6-8 Jan 1998	117	.	.
Ventnor Reserve (b)	8-10 Oct 1998	150	.	.
Ventnor Reserve (c)	15-17 Oct 1998	150	.	.
Ventnor Reserve (d)	22-24 Oct 1998	150	.	.
Silverleaves	12-14 Feb 1998	111	22	.
Oswin-Rob. Reserve (a)	14-16 May 1999	130	1	.
Oswin-Rob. Reserve (b)	17-19 May 1999	150	5	.
Oswin-Rob. Reserve (c)	28-30 Jun 2004	60	.	.
Rhyll Swamp	26-28 Jan 1998	137	3	1
Rowell Swamp (a)	11-13 Nov 1997	120	1	.
Rowell Swamp (b)	27-29 Apr 1998	30	.	.
Conservation Hill (a)	14-16 Dec 1997	145	27	3
Conservation Hill (b)	29-31 Jan 1998	121	.	.
Conservation Hill (c)	1-3 Apr 1999	90	20	2
Churchill Island (a)	25-27 Jan 1999	90	25	6
Churchill Island (b)	15-17 Mar 1999	90	19	1
Cape Woolamai (a)	in Feb 1999	90	.	4
Cape Woolamai (b)	18-20 May 2000	60	10	.
Totals		48 2132	135	17

Island, Harkin (2000) caught four Water Rats (*Hydromys chrysogaster*). Diggings suspected to have been made by a Long-nosed Potoroo *Potorous tridactylus* were observed at Rowell Swamp but no potoroos were caught there during 48 cage-trap nights, nor recorded using hair-tubes. Following the use of a remotely triggered camera, this activity was attributed to a Bassian Thrush *Zoothera hululata*. Two records of Long-nosed Potoroo were made during the study period. A dead, adult male was collected from a beach along the north coast in May 2003 and a dying, adult male was found beside a road at the eastern end of the island in May 2004. Likewise, there were several records of Tasmanian Bettongs *Bettongia gaimardi* which had escaped from a wildlife park on Phillip Island just prior to this study (P Dann pers. comm.).

Five microbat species were trapped during a single-night exercise in November 1997 using three harp-traps in Rhyll Swamp; the Little Forest Bat *Vespalellus vulturinus*, Large Forest Bat *V. darlingtoni*, Chocolate Wattled Bat *Chalinolobus morio*, Gould's Wattled Bat *C. gouldi* and Lesser Long-eared Bat *Nyctophylus geoffroyi* (Table 2). Also, the distinctive audible call of White-striped Freetail-bats

*Tadarida australis* was noted frequently, particularly in coastal areas around the island. During a study over 102 harp-trap-nights at the Koala Conservation Centre, central Phillip Island, in 1999, Campbell *et al.* (2005) recorded the Eastern False Pipistrelle *Falsistrellus tasmaniensis*, in addition to the above species (Table 2).

Swamp Wallabies *Wallabia bicolor*, Common Brushtail Possums *Trichosurus vulpecula*, Common Ringtail Possums *Pseudocheirus peregrinus*, Koalas *Phascolarctos cinereus*, Rabbits *Oryctolagus cuniculus*, Hares *Lepus capensis*, Red Foxes *Vulpes vulpes*, cats *Felis catus* and Black Rats were recorded during spot-light surveys. All these species were found across the entire island. Day-time strip-transect sampling in the 100 hectare Oswin-Roberts Reserve yielded estimates of about 192 Swamp Wallabies in August 1998, 280 in June 2004, and 200 in September 2005. In the 60 hectare Ventnor Koala Reserve, estimates were 60 Swamp Wallabies in July 2002, 80 in June 2004, and 40 in September 2005. Of the three arboreal species recorded on the island, Common Ringtail Possums were the most commonly seen. For example, in a 1 km circuit in Oswin-Roberts Reserve, Common Ringtail Possums were observed

**Table 2.** Forest bats caught during harp-trapping on Phillip Island. Data for the Koala Centre come from Campbell (2000).

Species	Common name	Rhyll Swamp 1997		Koala Centre 1999	
		No.	%	No.	%
<i>Vespadelus vulturnus</i>	Little Forest Bat	95	86	284	26
<i>V. darlingtoni</i>	Large Forest Bat	6	5	330	32
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	5	5	19	2
<i>C. gouldii</i>	Gould's Wattled Bat	1	1	41	4
<i>Nyctophylus geoffroyi</i>	Lesser Long-eared Bat	3	3	373	36
<i>Falsistrellus tasmaniensis</i>	Eastern false Pipistrelle			2	>1

on all 12 spot-light occasions (range 2 to 11 possums, mean = 6); Koalas were noted twice and Common Brushtail Possums once. Island-wide monitoring of the Koala has recorded a decline in recent years, from 847 in 1973 to <20 in 2004 (Fig. 2). Two sightings, 15 km apart, of adult Eastern Grey Kangaroos *Macropus giganteus* were reported during the 2004/5 summer and in June 2005 one adult was sighted crossing the San Remo Bridge onto Phillip Island and through the township of Newhaven.

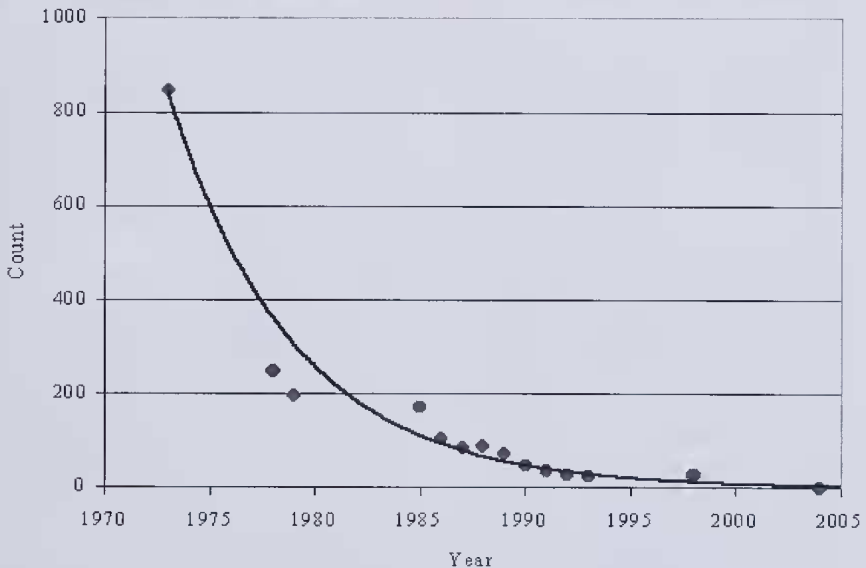
Rabbits are abundant and Hares were common across the island. Each year over the study period 37 to 91 Foxes and 58 to 93 Cats were killed. Lanyon (2000) caught

seven cats in 791 trap nights in shearwater colonies at the western end of the island. The only mammalian hair identified in a predator's stomach was of a Brown Rat *Rattus norvegicus* in one fox.

Finally, Echidnas *Tachyglossus aculeatus* were common across Phillip Island and were occasionally caught in cage-traps.

#### French Island

During 2001, from 2700 Elliott trap nights in six one-hectare sites in French Island National Park, Marks *et al.* (in press) recorded Bush Rats *R. fuscipes* and Swamp Rats densities of 15-34 and 2-12 individuals per hectare, respectively. In a study involving 5133 Elliott and cage trap



**Fig 2.** Numbers of Koalas counted on Phillip Island during censuses conducted in September in years between 1973 and 2004. The line represents an exponential regression through the data:  $y = 2E+147e^{-0.17x}$  ( $r^2 = 0.92$ ).

nights at 59 sites, Scott (2003) caught 742 individual Bush Rats (present in 98% of sites), 393 Swamp Rats (in 83% of sites) and 14 House Mice (which were generally associated with modified habitats). No Long-nosed Potoroo were trapped but there was evidence of digging activity at 32% of the sites (Scott 2003). A population was known to exist on French Island (Seebeck 1981) and individuals were occasionally reported during this study (M. Douglas, pers. comm.). Also, in a trapping study near the centre of the island during 2005/06, at least nine individuals were caught (K Handasyde 2006 pers. comm.). Water Rats have been reported around the island but their abundance and distribution were not assessed during this study.

Other native species recorded on French Island during this study, although not specifically surveyed, include Koala (common), Echidna (common) and a suite of microbat species (Little Forest Bat, Large Forest Bat, Chocolate Wattled Bat, Gould's Wattled Bat, White-striped Freetail-bats and Lesser Long-eared Bat; Johnston 2002). A single Eastern Grey Kangaroo was allegedly shot on the island in the early 1990s but little detail exists to describe how it came to be on the island (M Douglas 2004 pers. comm.). Also, a dead Platypus *Ornithorhynchus anatinus* that probably originated from off the island was found washed up at Spit Point during 2003 and a dead Common Wombat *Vombatus ursinus* washed ashore on the island in June 2005 (M Douglas 2004 pers. comm.).

Other extant exotic species include Black Rats, Rabbits, Cats, Sambar Deer *Cervus unicolor*, Goats *Capra hircus* and Pigs *Sus scrofa*; the latter having been recently released (A Ledden 2004 pers. comm.). During 2001, McTier (2002) monitored feral Cats across cleared grazing land and adjoining National Park and estimated the population of feral cats on French Island to be approximately 300. Johnston (unpublished data) caught 71 Cats in French Island National Park during two five-week trapping sessions. Sambar Deer were seen regularly when spotlighting in wetland areas such as Deuschers Swamp and Goats were widespread across the island, with large mobs (>20 individuals) occasionally

seen (Johnston 2002). Conspicuously absent from French Island was the Fox, although a dumped, dead cub was found beside a road during 1999; three other reported sightings are thought to have been misidentified Cats (Johnston 2002; Parks Victoria 2004 unpublished data).

## Discussion

In total, 16 native and seven exotic species were recorded on Phillip Island and 13 native and eight exotic species on French Island (Table 3). These data are representative only, as species monitoring was not exhaustive. For example, there are several bat species that may visit or reside in low numbers but were not recorded in this study. French Island in particular has not been fully surveyed for bat fauna. It is unlikely, however, that large populations of mammals remain undiscovered on the islands. Conversely, several records, namely Long-nosed Potoroos on Phillip Island and Eastern Grey Kangaroos on both Phillip and French Islands, are likely to represent individual arrivals and wildlife park escapes, rather than resident populations. These large bodied species probably would have been recorded more frequently had viable populations been extant on the respective islands.

This study represents a unique point in time for mammalian occupation of the islands in Western Port. Species compositions have changed in the past and are likely to change in the future. A review of previous records of mammals on these islands places this study in a temporal perspective.

## Pre-European

Prior to separation from the mainland 10 000 years ago, the areas now occupied by Phillip and French Islands could have contained most of the mammalian species that were resident in south-eastern Australia. However, the now-islands are thought to have been either surrounded by open plains or swamp, which could have limited the sizes of resident populations (Rosengren 1988; Garden 2002). Once separated, low genetic diversity within the populations and Aboriginal hunting pressure or catastrophic events, such as fire or prolonged drought, may have caused local extinctions.

Table 3. Terrestrial mammals of Phillip and French Islands, Western Port, Victoria. Data for 1970-80 combines Andrews *et al.* 1984 and records from the Atlas of Victorian Wildlife Database. + indicates presence recorded. \* indicates temporary visitors, either escapees from a local wildlife park, or individuals that crossed to Phillip Island via the San Remo Bridge. † indicates dead individuals dumped or washed ashore.

Species	Common name	Phillip I		French I		Status
		Estab- lished	Early 1900s	Estab- lished	Early 1900s	
Australian native						
<i>Ornithorhynchus anatinus</i>	Platypus					visitor †
<i>Tachyglyssus aculeatus</i>	Short-beaked Echidna		+			breeding
<i>Isodon obesulus</i>	Southern Brown Bandicoot	~1930s	+		+	absent
<i>Vombatus ursinus</i>	Common Wombat					absent
<i>Phascogaleos cinereus</i>	Koala	~1920s	+		+	breeding
<i>Trichosurus vulpecula</i>	Comm. Brush-tail Possum	~1950s	+		+	breeding
<i>Pseudocheirus peregrinus</i>	Comm. Ringtail Possum	~1920s	+		+	breeding
<i>Bettongia gaimardi</i>	Tasmanian Bettong					visitor*
<i>Potorous tridactylus</i>	Long-nosed Potoroo		+		+	breeding
<i>Macropus giganteus</i>	Eastern Grey Kangaroo		+		+	visitor*†
<i>Thylogale billardieri</i>	Tasmanian Pademelon		+		+	visitor*
<i>Wallabia bicolor</i>	Swamp (black) Wallaby		+		+	breeding
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox		+		+	visitor
<i>Pteropus scopulinus</i>	Little red Flying-fox		+		+	visitor
<i>Tadarida australis</i>	White-striped Freetail-bat					breeding
<i>Chalinolobus gouldii</i>	Gould's Wattle Bat		+		+	visitor
<i>Chalinolobus morio</i>	Chocolate Wattle Bat		+		+	breeding
<i>Falsisorex tasmaniensis</i>	Eastern False Pipistrelle		+		+	breeding
<i>Minioternus schreibersii</i>	Common Bent-wing Bat		+		+	visitor
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		+		+	breeding
<i>Vespudelus darlingtoni</i>	Large Forest Bat		+		+	breeding
<i>Vespudelus regulus</i>	Southern Forest Bat		+		+	visitor
<i>Vespudelus vittatus</i>	Little Forest Bat		+		+	breeding
<i>Hychromys chrysogaster</i>	Water Rat		+		+	breeding
<i>Rattus fuscipes</i>	Bush Rat		+		+	breeding
<i>Rattus lutreolus</i>	Swamp Rat		+		+	breeding

Table 3 (cont.)  
Species

Common name	Phillip I		French I		Status
	Early 1900s	1970-80	Early 1900s	1970-80	
Non-native					
<i>Mus musculus</i>	+	+		+	breeding
<i>Rattus rattus</i>	+	+		+	breeding
<i>Rattus norvegicus</i>					absent
<i>Vulpes vulpes</i>		+		+	visitor †
<i>Felis catus</i>		+		+	breeding
<i>Capra hircus</i>					breeding
<i>Cervus dama</i>					absent
<i>Cervus elaphus</i>					absent
<i>Cervus unicolor</i>					breeding
<i>Sus seroja</i>				+	breeding
<i>Lepus capensis</i>					absent
<i>Oryctolagus cuniculus</i>	+	+		+	breeding
	Established	1970-80	Established	1970-80	1997

Analysis of mammalian bones in Aboriginal middens provides little evidence of species present during the several thousand years prior to European arrival. A midden at Point Grant, Phillip Island, dated at 2000 to 1500 years ago had bones of 'a wallaby, a possum and some seal' (D Gaughwin 1987 pers. comm., in a letter to the Phillip Island Nature Park). At Forrest Caves on Phillip Island, excavations recovered bones of a 'rufous-bellied wallaby' (possibly a Red-necked Wallaby, *Macropus rufogriseus*), a 'yellow-footed phascogale or marsupial mouse' (possibly an *Antechinus* species) and 'a rat' (possibly a Bush Rat) (Gill 1968). Likewise, a midden at Stinker Bay, Phillip Island (dated to 250 years ago) contained bones of one Red-necked Wallaby and Bush Rat teeth (Gaughwin and Brennan 1986). Given the possible transience of Aborigines in the area (Gaughwin 1981, 1983; Cole 1984; Belcher and Hastings 1983) it is possible that the wallaby and possum bones and cultural items in the middens came from carcasses brought to, rather than killed on, the islands (Gaughwin 1981). Therefore, the middens do not unambiguously record the status of any mammalian species on the islands prior to European settlement.

1800s

European discovery of the islands was by George Bass in 1798, although French Island was considered to be part of the mainland until 1801 (Scott 1917). Bass noted a colony of Australian Fur Seals *Arctocephalus pusillus doriferus* at Seal Rocks off the western tip of Phillip Island, which drew some interest from early sealers. Sealers had operated on Seal Rocks between March and December 1801 (journals of Murray, reported in Cole 1984), and in 1809, the brigantine *Active* collected 1300 skins from Western Port (Cumpston 1973). Sealers occasionally camped on the rocks or on Phillip Island. A semi-permanent sealers' camp was present at Rhyll in 1826, when the island was visited by Dumont d'Urville (Cole 1984). There are no records from the early explorers or sealers of other mammals on the islands.

Soon after 1842 the first European farmers, the McHaffie family, arrived on

Phillip Island and started to clear the land (Gliddon 1968). AD Hardy, the elder daughter of J McHaffie, recorded in a diary that native mammals present at the time of settlement included Bush Rats, Bandicoots (probably the Southern Brown Bandicoot *Isoodon obesulus*) and Water Rats (quoted in Gliddon 1968). Wallabies 'appeared later, but it was not known how they gained access', Kangaroos were 'shot at times', there were 'no koalas or dingos', and 'seals were plentiful at Seal Rocks' (Hardy, in Gliddon 1968). The McHaffies became active members of the Acclimatisation Society and introduced Fallow Deer *Cervus dama*, Red Deer *C. elaphus*, Hares, Belgian Rabbits *Oryctolagus* sp., Pigs and Cats (Gliddon 1968). Red Deer did not establish, Pigs established a feral population for a brief period (Seddon 1975) and Belgian Rabbits probably were absorbed into the later introduction of European Rabbit.

In 1855, Blandowski (1857) noted that 'the wallaby is found scattered over the whole of Phillip Island, but is especially numerous on the eastern portion', but was absent from French Island. Around the same time, Wheelwright (1862) commented that the Dark-brown Swamp Wallaby *W. bicolor* 'abound in the scrub on Phillip Island'. The apparent abundance of Swamp Wallabies in the mid 1850s contrasts with their apparent absence ten years earlier (suggested by Hardy). Either Swamp Wallabies were present on Phillip Island prior to settlement and were not recognised until land clearance made them more obvious, or they colonised around the same time as the early settlers and the population quickly expanded.

Blandowski (1857) also mentioned that Water Rats were abundant around lagoons and waterways on both Phillip and French Island. Wheelwright (1862) believed a small, yellow-bellied kangaroo, called a pademelon, was present on Phillip Island. This could have been the Tasmanian Pademelon *Thylagale billardierii* which occurred elsewhere along the Victorian coast (Menkhorst 1995). Brushtail and Ringtail Possums were common in the Western Port area, although not specifically mentioned to be on Phillip or French Island (Wheelwright 1862).

In 1868, Phillip Island was surveyed and partly opened to free-settlement. At the time, there were about 2000 cattle, 10,000 sheep and over 200 deer resident (Gliddon 1968). Vegetated areas continued to be cleared and burned to provide pasture, and logged to provide fuel for chicory kilns. Rabbits were released on the island, to provide targets for shooting parties (H Cleeland 2004 pers. comm.) and Koalas were introduced as a novelty (Gliddon 1968).

In summary, based on the notes of early explorers and residents, mammalian populations on Phillip Island prior to European settlement included Water Rats, Bush Rats, Southern Brown Bandicoots and possibly Swamp Wallabies and Tasmanian Pademelons. If Tasmanian Pademelon were present, their numbers are likely to have been low and they quickly became locally extinct, as there were no further records of them. There also may have been a small population of Eastern Grey Kangaroos that likewise became locally extinct, although those reported to Hardy (in Gliddon 1968) could have arrived with the settlers or have been misidentified wallabies. Without further evidence, it is assumed they were not present in a viable population prior to European settlement. By the end of the century there had been successful introductions to Phillip Island of Cats, Rabbits, Brown Hares, Fallow Deer and Koalas, and probably House Mice and Black Rats.

On French Island, European settlement proceeded at a slower rate than on Phillip Island, and there is less information on species present. Given later observations, it is likely that these included Water Rats (which Blandowski (1857) did report as being present), Bush Rats, Swamp Rats, and Long-nosed Potoroos. Koalas were reportedly released on the island in the 1890s and, in the absence of predators and diseases such as chlamydiosis, quickly became widespread (Parks Victoria 1998). Other successful introductions to French Island by the end of the 1800s perhaps included Rabbits, Goats, House Mice, Black Rats and Sambar Deer, for which periods of introduction are not known.



## 1900s

Red Foxes were reported on Phillip Island for the first time in about 1905. Although their mode of arrival is not known, several accounts suggest individuals may have swum to the island (Gliddon 1968). Within 15 years it was recognised that Red Foxes were having a devastating impact on seabird colonies in the island (Gabriel 1919). Curiously, Foxes have never established populations on French Island.

During the early 1900s, there was an increased settlement and development of townships on both islands, particularly Phillip Island, along with community interest in nature conservation (Seddon 1975). Reserves were established and, in addition to continued clearing, some revegetation projects commenced. On French Island, Koalas had become so numerous by 1923 that translocations off the island, including to Phillip Island, were initiated (Menkhurst 1995). Shortly thereafter, overbrowsing on Phillip Island vegetation was noticed; translocations of Koalas from that island commenced in the 1940s (Gliddon 1968). Further species were introduced to the islands by local residents, many by the Grayden family who were clearing land near Stony Point on the Mornington Peninsula and bringing marsupials they found back to their home at Newhaven, Phillip Island (K Grayden 2004 pers. comm.). Anecdotal reports for the establishment of non-endemic, native mammal populations on Phillip Island include Common Brushtail Possums by the 1920s and Short-beaked Echidnas by the 1930s (K Grayden and H Cleeland 2004 pers. comm.). Common Ringtail Possums and Eastern Grey Kangaroo individuals were introduced around the same time but did not establish wild populations (K Grayden 2004 pers. comm.). On French Island between 1900-05, a pair of Common Ringtail Possums was released by J Ratford (C Chandler 2004 pers. comm.). A breeding population of this species had established by the 1920s but became extinct by the 1940s (C Chandler 2004 pers. comm.). A feral Cat population was recognised on French Island by the 1930s (Lewis 1934) and Short-beaked Echidnas apparently had established by the 1950s (C Chandler 2004 pers. comm.).

In the 1930s and 40s, sport shooting became a popular pastime on Phillip Island. This resulted in the eradication of Fallow Deer, the near elimination of Swamp Wallabies and the further introduction of Rabbits to provide an alternative target (K Grayden 2004 pers. comm.).

A bridge connecting Phillip Island to the mainland was opened in 1945, providing a land route for animals like possums and Foxes (Gliddon 1968). Perhaps aided by this, Common Ringtail Possums had established populations on the island by the 1960s (K Grayden 2004 pers. comm.). The bridge stimulated further human settlements which exacerbated pressures on the native fauna, such as land clearing and roaming dogs. Southern Brown Bandicoots and Bush Rats, which were plentiful until about the 1960s, became locally extinct (K Grayden 2004 pers. comm.). A wildlife park opened on the island in the 1960s. Mammalian escapees from the park have included Long-nosed Potoroo, Tasmanian Pademelons and Eastern Grey Kangaroos, but none of these established breeding populations.

During the late 1900s, an increased awareness of conservation stimulated further revegetation activities, pest species control, native species protection and data recording. Much of this interest on Phillip Island was stimulated by concern over declining numbers of Koala on the island (see Every 1986). Summarising records from 1970 to 1980, Andrew *et al.* (1984) reported 10 native and 6 exotic terrestrial species on Phillip Island and 11 native and 7 exotic species on French Island (Table 3). About half of the native species were bats and flying foxes, which probably had existed on or visited the islands since prior to European settlement but had not been recorded previously. On a species list for French Island, Belcher and Hastings (1983) included the Grey-headed Flying-fox *Pteropus poliocephalus*, which probably referred to visiting individuals. Of the remaining species listed by Andrew *et al.* (1984), the only endemic natives were Water Rats and possibly Swamp Wallabies on Phillip Island, and Water Rats, Bush Rats, Swamp Rats, and Long-nosed Potoroos on French Island. Amongst the exotics, Foxes were found only on Phillip

Island, while Sambar Deer, Goats and wild Dogs *Canus lupus* were found only on French Island.

Between the 1980s (Andrew *et al.* 1984) and 2005 (this study), the only new species recorded for the islands were microbats (White-striped Freetail-bat and Eastern False Pipistrelle on Phillip Island, and White-striped Freetail-bat and Chocolate Watted Bats on French Island) and the single record of Swamp Rat for Phillip Island (R Baird 1998 pers. comm.). The bats probably were unrecorded residents or visitors, rather than new colonists. Swamp Rat may have existed on Phillip Island even prior to European settlement and been unreported up to the single capture at Conservation Hill in the 1980s. The subsequent local extinction of this population could have occurred as late as the 1990s, when we noted deterioration of the distinctive 'runways' at this location. Also between the 1980s and 2005, wild dogs were removed from French Island (Parks Victoria, unpublished data) and Rabbits were removed from 10 hectare Churchill Island, adjacent to Phillip Island (Phillip Island Nature Parks, unpublished data).

### Conclusions

On Phillip Island, it appears that European settlement resulted in the local extinction of Southern Brown Bandicoots and Bush Rats and possibly Tasmanian Pademelons and Swamp Rats, while the survivors were a suite of microbats, Water Rats and Swamp Wallabies. On French Island, all species present prior to European settlement were extant in 2004, including a suite of microbats, Water Rats, Bush Rats and Swamp Rats and Long-nosed Potoroos. Long-nosed Potoroos are classified as 'threatened' (DNRE 2002), and the population on French Island represents a valuable component of the species.

Of the non-endemic, native species introduced to the islands, the Koala has had the greatest impact. Translocations of Koala from Phillip Island continued until 1978, when it was recognised that the population on the island was declining (Every 1986, Menkhorst 1995). From French Island, over 7000 individuals had been relocated off the island up to 1999 (Parks Victoria 2000) and translocations are continuing.

Although detrimental to vegetation on both islands, the isolated Koala populations provided a source to restock areas of the mainland where Koalas were eliminated by deforestation, hunting and disease (Menkhorst 1995). Koalas also represented a flag-species for conservation groups aiming to protect native habitat, particularly on Phillip Island. Koalas now appear to be approaching local extinction on Phillip Island, perhaps due to limited habitat and increased mortalities on roads and from dog attacks.

Considerable effort now goes into the control of feral species, particularly Foxes, on Phillip Island. A principal factor in the demise of the small, native, ground mammals on Phillip Island, but the survival of comparable species on French Island could be the introduction of Red Foxes to only Phillip Island. In addition, on Phillip Island Foxes are considered to be the greatest land-based threat to Little Penguins *Eudyptula minor* (Dann 1992) and Short-tailed Shearwaters *Puffinus tenuirostris* are a major component of their diet (Kirkwood *et al.* 2002; 2004). French Island is the only significant Victorian land mass where Foxes are absent and as such is a site of state significance for wildlife conservation (Andrew *et al.* 1984). The eradication of Red Fox from Phillip Island is a priority for the conservation of the fauna remaining on that island.

### Postscript

On 24 April 2006, a dead Yellow-bellied Sheath-tail-bat *Saccolaimus flaviventris* was found at Churchill Island, the first record of this species on the islands of Western Port.

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